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(54) **ELECTRONIC SHUTTER DRIVING METHOD FOR SOLID-STATE IMAGE PICKUP DEVICE AND SOLID-STATE IMAGE PICKUP DEVICE**

(57) Abstract:
PROBLEM TO BE SOLVED: To provide an electronic shutter driving method for solid-state image pickup device and a solid-state image pickup devicewith which a sharp still picture can be provided by simultaneously providing the same object optical image irradiation time when electronic shutter operation is performed.
SOLUTION: First of alla reset switch Sya and a switch Tr for charge transfer are turned on. After the potential of a cathode Sd' of a photodiode D and the potential of a non-grounded side terminal Sc' of a capacitor C are respectively set to a reset potential Vsthe reset switch Sta is turned off but the switch Tr for charge transfer is still turned onand in such a state the object optical image is irradiated by the photodiode D. The charge of the photodiode D at that time is transferred and held through the switch Tr for charge transfer to the capacitor C for charge storage. In such a statea switch SWv1 for video signal read is turned on.

CLAIMS

[Claim(s)]
[Claim 1]An image sensor from which resistance or an accumulated electric charge changes according to incident light quantity from an object light image characterized by

comprising the followingA switch for reset which applies fixed voltage to said image sensor and in which a fixed electric charge is stored upA switch for charge transfer which transmits an electric charge accumulated in said image sensorand a capacitor for charge storages which accumulates an electric charge from said image sensor transmitted by said switch for charge transferAn electronic shutter drive method of a solid state camera which possesses a switch for video signal outputs which sends out an electric charge accumulated in said capacitor for charge storages as a video signal as each pixel of two or more pixels arranged at two-dimensional matrix form.
The 1st step that makes one simultaneously said switch for reset and said switch for charge transfer of all the pixelsand makes said image sensor of all the pixelsand potential of said capacitor for charge storages the value same just before an image pick-up of an object light image.
The 2nd step that makes off simultaneously said switch for reset and said switch for charge transfer of all the pixels following said 1st step.
The 3rd step that transmits an electric charge according to incident light quantity from an object light image which controlled only said switch for charge transfer of all the pixels to one after predetermined timeand was accumulated in said image sensor following said 2nd step to said capacitor for charge storages.

[Claim 2]An image sensor from which resistance or an accumulated electric charge changes according to incident light quantity from an object light imageA switch for reset which applies fixed voltage to said image sensor and in which a fixed electric charge is stored upA switch for charge transfer which transmits an electric charge accumulated in said image sensorand a capacitor for charge storages which accumulates an electric charge from said image sensor transmitted by said switch for charge transferIt is an electronic shutter drive method of a solid state camera which possesses a switch for video signal outputs which sends out an electric charge accumulated in said capacitor for charge storages as a video signal as each pixel of two or more pixels arranged at two-dimensional matrix formThe 1st step that makes one simultaneously said switch for reset and said switch for charge transfer of all the pixelsand makes said image sensor of all the pixelsand potential of said capacitor for charge storages the value same just before an image pick-up of an object light imageBy turning OFF said switch for reset

of all the pixelscontrolling said switch for charge transfer to one as it is following said 1st stepand transmitting an electric charge according to incident light quantity from an object light image accumulated in said image sensor to said capacitor for charge storagesThe 2nd step to which charge quantity of said image sensor and said capacitor for charge storages is changed simultaneouslyAn electronic shutter drive method of a solid state camera by which the 3rd step that turns OFF said switch for charge transfer of all the pixels after predetermined timeand controls said switch for video signal outputs of each pixel to one one by one being included following said 2nd step.

[Claim 3]An image sensor from which resistance or an accumulated electric charge changes according to incident light quantity from an object light image characterized by comprising the followingA switch for reset which applies fixed voltage to said image sensor and in which a fixed electric charge is stored upA switch for charge transfer which transmits an electric charge accumulated in said image sensorand a capacitor for charge storages which accumulates an electric charge from said image sensor transmitted by said switch for charge transferA solid state camera which possesses a switch for video signal outputs which sends out an electric charge accumulated in said capacitor for charge storages as a video signal as each pixel of two or more pixels arranged at two-dimensional matrix form.

After making one simultaneously said switch for reset and said switch for charge transfer of all the pixelsmake off said switch for reset of all the pixelsand.An electronic shutter drive to which charge quantity of said image sensor and said capacitor for charge storages is simultaneously changed by controlling said switch for charge transfer to predetermined time oneand transmitting an electric charge according to incident light quantity from an object light image accumulated in said image sensor to said capacitor for charge storages.

A reading means which controls an electric charge accumulated in said capacitor for charge storages of all the pixels in order of a predetermined pixelcontrols said switch for video signal outputs to one one by oneand is serially read as a video signal.

[Claim 4]The solid state camera according to claim 3 making capacity value of said capacitor for charge storages into a value as for which size becomes rather than stray capacitance of said image sensor.

[Claim 5]An image sensor from which resistance changes according to incident light quantity from an object light imageA constant current source which sends fixed current through said image sensorand a switch for voltage transmission which transmits voltage of said image sensorA capacitor for voltage accumulation transmitted in voltage changed into voltage change by sending fixed current from said constant current source in a change in resistance by incident light quantity from said object light image when said switch for voltage transmission is oneVoltage accumulated in said capacitor for voltage accumulation is a solid state camera which possesses a switch for video signal outputs sent out as a video signal as each pixel of two or more pixels arranged at two-dimensional matrix formPrescribed period one of said switch for voltage transmission of all the pixels is carried out simultaneouslyAn electronic shutter drive made to hold during the OFF of voltage from said image sensor of each pixel transmitted to said capacitor for voltage accumulation of each pixel of said switch for voltage transmissionA solid state camera controlling voltage at the time of accumulation of said capacitor for voltage accumulation of all the pixels in order of a predetermined pixelcontrolling said switch for video signal outputs to one one by oneand having a reading means serially read as a video signal.

[Claim 6]An image sensor from which resistance changes according to incident light quantity from an object light imageA constant current source which sends fixed current through said image sensorand a switch for voltage transmission which transmits voltage of said image sensorA capacitor for voltage accumulation by which voltage changed into voltage change by sending fixed current from said constant current source in a change in resistance by incident light quantity from said object light image is transmitted when said switch for voltage transmission is oneIt is a solid state camera which possesses a switch for video signal outputs which sends out voltage accumulated in said capacitor for voltage accumulation as a video signal as each pixel of two or more pixels arranged at two-dimensional matrix formA shutter pattern generating means which generates arbitrary electronic shutter patternsPrescribed period one of said switch for voltage transmission of a pixel decided by said electronic shutter pattern generated in said shutter pattern generating means is carried out simultaneouslyAfter transmitting voltage from said image sensor to said capacitor for voltage

accumulationvoltage at the time of accumulation of an electronic shutter driving means which makes off said switch for voltage transmission of a pixel decided by said electronic shutter pattern and in which transmission voltage is stored upand said capacitor for voltage accumulation of all the pixelsA solid state camera controlling said switch for video signal outputs to one one by one in order of a predetermined pixeland having a reading means serially read as a video signal.
[Claim 7]The solid state camera according to claim 5 or 6 forming further an electric power switch which impresses power supply voltage to said constant current source when said switch for voltage transmission is oneand intercepts power supply voltage to said constant current source when said switch for voltage transmission is OFF.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the electronic shutter drive method of a solid state camera and solid state camera with which the electronic shutter drive method of a solid state camera and the solid state camera were startedespecially the image sensor has been arranged at matrix form.
[0002]
[Description of the Prior Art]Drawing 10 shows the circuit diagram of an example of the important section of the conventional solid state camera. In the figurethe switches SWa and SWb by photo-diode PD1 and a MOSFET (field effect transistor) constitute one pixel of a solid state camera.By drawing 10it is perpendicularly accepted by 2 pixels and the solid state camera is illustratedalthough two-dimensional arrangement of a majority of this pixel is carried out.In the figurethe gate of the switch SWb for video signal outputs of each pixel arranged horizontally is connected common to V1 lineThe source of the switch SWb for video signal outputs of each pixel arranged perpendicularly is connected to the output terminal OUT in common via the source and drain of switch SH1 by a MOSFET.[0003]Switch SH2 by a MOSFET is connected to the switch equivalent to SWb of the pixel similarly arranged to perpendicularly it does not illustrate.The horizontal driving pulse H1 is impressed to the gate of switch SH1.The vertical driving pulse V1 is impressed to the gate of the switch SWb.
[0004]Nextthe outline of operation of the solid state

camera used by a system conventionally [this] is explained taking the case of one pixel.Firstimage formation of the object light image is carried out to photo-diode (sensor) PD1. Hereby the S1. pulse impressed to the gate of the switch SWa for resetthe switch SWa for reset is made one and the cathode voltage of photo-diode PD1 is beforehand reset to Ecc. The charge quantity in which photo-diode PD1 is accumulated according to the light volume from a photographic subject changes after reset.
[0005]Nextare one [the switch SWb for video signal outputs and SH1 / the vertical driving pulse V1 and the horizontal driving pulse H1]respectivelyand the charge quantity which changed from photo-diode PD1 by this lets the switch SWb for video signal outputsand SH1 passand is sent to the output terminal OUT as a picture signal. At this timesince the electric charge of photo-diode PD1 is consumedit makes the switch SWa for reset one againand is made into the following image pick-up waiting state.
[0006]In the state where the switch SWb of each pixel which same operation is performed and is horizontally arranged about other pixels is considered as one by the same vertical driving pulse V1When switch SH1 and SH2 grade are considered one by one as one by the horizontal driving pulse H1 and H2 gradethe charge quantity of the photo-diode of each pixel arranged horizontally is serially sent to the output terminal OUT one by one as a picture signal.[0007]In the state where the switch of the switch SWb for video signal outputs of each pixel arranged by the following vertical driving pulse V2 to the horizontal direction for following one line is considered as one if read-out for one line finishesThe charge quantity of each photo-diode of the line is serially sent to the output terminal OUT one by one as a picture signalwhen switch SH1 and SH2 grade are considered one by one as one by the horizontal driving pulse H1 and H2 grade.[0008]Howeverif the picture signal sent to the output terminal OUT is used as standard-method television signalssuch as NTSC system or a PAL systemSince it is necessary to scan per linein the above-mentioned conventional solid state camera. After forming the switch SWa for reset corresponding to each photo-diode and making these the one within the retrace line period of a line simultaneouslythe switch SWb for video signal outputsetc. are made the one per within the video-signal period of a line one by one.Thereforethe irradiation time of the object light image acquired by carrying out the switch SWb for video signal outputsetc. to one immediately after one [the switch SWa for reset]Since the irradiation time of the

object light image acquired in the line period of the last direction by carrying out the switch SWb for video signal outputsetc. to one differs after one [the switch SWa for reset]there is a fault that the size of the video signal to the same object light image is not constant.
[0009]Thenthe solid state camera which makes storage time for every pixel regularity is conventionally known by performing simultaneously read-out of the line of oneand the electronic shutter of other lines during a 1-pixel signal period (JPH11-239299A).
[0010]The proposal which the electronic shutter drive of a solid state camera tends to be made using a conventional CMOS type image sensor is made variously (for exampleJPH11-177076A). It is the composition of having provided the accumulating part which accumulates an electric charge temporarily between the photoelectric conversion part and the amplifier in this conventional solid state camerahaving provided the second transfer part between the first transfer part and the accumulating partand the amplifier between the photoelectric conversion part and the accumulating partrespectivelyand having given the electronic shutter function to all the pixel coincidence.
[0011]Namelyin this conventional solid state cameraas shown in drawing 11the electric charge accumulated in photoelectric conversion part Pd according to the **** object light figure is transmitted to the accumulating part 1e by making the first transfer part 1a oneNextafter turning OFF the first transfer part 1athe electric charge transmitted to the accumulating part 1e is further transmitted to the amplifier JFET by making the second transfer part 1b one. The electric charge transmitted to the amplifier JFET is used as a video signal which carried out the shutter drive to all the pixel coincidence.
[0012]
[Problem to be solved by the invention]By the waythe shutter speed of the electronic shutter of a solid state camera is till the moment of carrying out the switch for video signal outputs to one from the moment the switch for reset changed from one at OFFand if this is not simultaneously performed in the image sensor of the whole 1 screenclear Still Picture Sub-Division is not obtained. Howeverin the conventional solid state camera given in JPH11-239299Athe electronic shutter of the whole object light image does not becomebut merely fixes storage time for every pixel onlyand is a requestOnly an indistinct picture is acquiredwhen the whole picture of one sheet is not simultaneously operated by an electronic

shuttertherefore it picturizes an animation.
[0013]On the other handin the conventional solid state camera indicated by JPH11-177076Aaccumulation of the following object light image starts the moment of turning OFF the first transfer part 1a of drawing 11. Thereforea storage period is till the moment of making the first transfer part 1a one next from the moment of turning OFFand before the first transfer part 1a of this period is turned onit needs to reset the electric charge of the accumulating part 1e. For this reasonthe reset part 1c is neededimage sensor constituent face products other than photoelectric conversion part Pd increasethe utilization efficiency over an object light image fallssensitivity fallsand there is a problem of also generating the noise by a reset action further.
[0014]The electric charge of photoelectric conversion part Pd according to an object light image since photoelectric conversion part Pd does not have a reset functionEven when the first transfer part 1a is turned onit is not thoroughly transmitted to the accumulating part 1ebut a part remains in photoelectric conversion part Pdand since it is mixed at the time of accumulation of the following incident lightthis electric charge that remained is difficult to obtain the good momentary images as an electronic shutter picture. Thereforewhen considering it as an outputted imageby irradiating with photoelectric conversion part Pd of the whole 1 screen by the object light image of the same time by an electronic shutter in the conventional solid state camera. The reset part 1c is requiredutilization efficiency is bada reset noise is also generatedand it becomes image quality degradationand remaining charge is also contained in photoelectric conversion part Pdand there is a problem that good Still Picture Sub-Division is not obtained.[0015]When it is made in view of the above point and electronic shutter operation is performedan object of this invention is to provide the electronic shutter drive method of a solid state camera and solid state camera which can obtain a clear still picture by acquiring the same object light image irradiation time simultaneously.
[0016]Other purposes of this invention have a reset part in providing the electronic shutter drive method of a solid state camera and solid state camera which can obtain good Still Picture Sub-Division in which remaining charge with unnecessary and sufficient utilization efficiency is not contained.
[0017]
[Means for solving problem]This invention in order to

attain the above-mentioned purpose an electronic shutter drive method of this inventionAn image sensor from which resistance or an accumulated electric charge changes according to incident light quantity from an object light imageA switch for reset which applies fixed voltage to an image sensor and in which a fixed electric charge is stored upA switch for charge transfer which transmits an electric charge accumulated in an image sensorand a capacitor for charge storages which accumulates an electric charge from an image sensor transmitted by the switch for charge transferAn electronic shutter drive method of a solid state camera which possesses a switch for video signal outputs which sends out an electric charge accumulated in a capacitor for charge storages as a video signal as each pixel of two or more pixels arranged at two-dimensional matrix form is characterized by comprising:
The 1st step that makes one simultaneously a switch for reset and a switch for charge transfer of all the pixelsand makes an image sensor of all the pixelsand potential of a capacitor for charge storages the value same just before an image pick-up of an object light image.
The 2nd step that makes off simultaneously a switch for reset and a switch for charge transfer of all the pixels following the 1st step.
The 3rd step that transmits an electric charge according to incident light quantity from an object light image which controlled only a switch for charge transfer of all the pixels to one after predetermined timeand was accumulated in an image sensor following the 2nd step to a capacitor for charge storages.

[0018]In this inventionan electric charge according to light volume of an object light image which entered into all the image sensors can be simultaneously accumulated in a capacitor for charge storages of all the pixels with a point temporarily [the]respectively.[0019]This invention this invention electronic shutter drive methodAn image sensor from which resistance or an accumulated electric charge changes according to incident light quantity from an object light image in order to attain the above-mentioned purposeA switch for reset which applies fixed voltage to an image sensor and in which a fixed electric charge is stored upA switch for charge transfer which transmits an electric charge accumulated in an image sensorand a capacitor for charge storages which accumulates an electric charge from an image sensor transmitted by the switch for charge transferAn electronic shutter drive method of a solid state

camera which possesses a switch for video signal outputs which sends out an electric charge accumulated in a capacitor for charge storages as a video signal as each pixel of two or more pixels arranged at two-dimensional matrix form is characterized by comprising:
The 1st step that makes one simultaneously a switch for reset and a switch for charge transfer of all the pixelsand makes an image sensor of all the pixelsand potential of a capacitor for charge storages the value same just before an image pick-up of an object light image.
Following the 1st stepturn OFF a switch for reset of all the pixelsand a switch for charge transfer is controlled to one as it isThe 2nd step to which charge quantity of an image sensor and a capacitor for charge storages is simultaneously changed by transmitting an electric charge according to incident light quantity from an object light image accumulated in an image sensor to a capacitor for charge storages.
The 3rd step that turns OFF a switch for charge transfer of all the pixels after predetermined timeand controls a switch for video signal outputs of each pixel to one one by one following the 2nd step.

[0020]The charge quantity of an image sensor and the capacitor for charge storages having made it make it change simultaneously by transmitting the electric charge according to the incident light quantity from the object light image accumulated in the image sensor of all the pixels to the capacitor for charge storages in this invention A sakeWhen the potential of an image sensor and the capacitor for charge storages is in the same statesuppose that the switch for charge transfer is off.
[0021]In order to attain the above-mentioned purposethis invention solid state cameraThe image sensor from which resistance or the accumulated electric charge changes according to the incident light quantity from an object light imageThe switch for reset which applies fixed voltage to an image sensor and in which a fixed electric charge is stored upThe switch for charge transfer which transmits the electric charge accumulated in the image sensorand the capacitor for charge storages which accumulates the electric charge from the image sensor transmitted by the switch for charge transferIt is a solid state camera which possesses the switch for video signal outputs which sends out the electric charge accumulated in the capacitor for charge storages as a video signal as each pixel of two or more pixels arranged at two-dimensional matrix formAfter making

one simultaneously the switch for reset and the switch for charge transfer of all the pixelsmake off the switch for reset of all the pixelsand. By controlling the switch for charge transfer to predetermined time oneand transmitting the electric charge according to the incident light quantity from the object light image accumulated in the image sensor to the capacitor for charge storagesControl the electric charge accumulated in the electronic shutter drive to which the charge quantity of an image sensor and the capacitor for charge storages is changed simultaneouslyand the capacitor for charge storages of all the pixels in order of a predetermined pixeland the switch for video signal outputs is controlled to one one by oneIt has composition which has a reading means serially read as a video signal.

[0022]The charge quantity of an image sensor and the capacitor for charge storages having made it make it change simultaneously by transmitting the electric charge according to the incident light quantity from the object light image accumulated in the image sensor of all the pixels to the capacitor for charge storages in this invention A sakeWhen the potential of an image sensor and the capacitor for charge storages is in the same statesuppose that the switch for charge transfer is off.

[0023]Hereas for the capacity value of the above-mentioned capacitor for charge storagesit is more desirable than the stray capacitance of an image sensor to make it the value as for which size becomes. When the switch for charge transfer is come by offit is because almost all electric charges are accumulated in the capacitor for charge storages.[0024]In order to attain the above-mentioned purposethe solid state camera of this inventionThe image sensor from which resistance changes according to the incident light quantity from an object light imageThe constant current source which sends fixed current through an image sensorand the switch for voltage transmission which transmits the voltage of an image sensorThe capacitor for voltage accumulation transmitted in the voltage changed into voltage change by sending fixed current from a constant current source in the change in resistance by the incident light quantity from an object light image when the switch for voltage transmission is oneThe voltage accumulated in the capacitor for voltage accumulation is a solid state camera which possesses the switch for video signal outputs sent out as a video signal as each pixel of two or more pixels arranged at two-dimensional matrix formAn electronic shutter drive which is made to carry out prescribed period one of the switch for voltage

transmission of all the pixels simultaneouslyand is made to hold during the OFF of the voltage from the image sensor of each pixel transmitted to the capacitor for voltage accumulation of each pixel of the switch for voltage transmissionThe voltage at the time of accumulation of the capacitor for voltage accumulation of all the pixels is controlled in order of a predetermined pixelthe switch for video signal outputs is controlled to one one by oneand it has composition which has a reading means serially read as a video signal.

[0025]In this inventioneven if it does not use a resetting meansit irradiates with the image sensor of all the pixels of the whole 1 screen by the object light image of the same time by an electronic shutterand an output video signal can be acquired.

[0026]The image sensor from which resistance changes according to the incident light quantity from an object light image in order that the solid state camera of this invention may attain the above-mentioned purposeThe constant current source which sends fixed current through an image sensorand the switch for voltage transmission which transmits the voltage of an image sensorThe capacitor for voltage accumulation by which the voltage changed into voltage change by sending fixed current from a constant current source in the change in resistance by the incident light quantity from an object light image is transmitted when the switch for voltage transmission is oneThe switch for video signal outputs which sends out the voltage accumulated in the capacitor for voltage accumulation as a video signalThe shutter pattern generating means which is a solid state camera provided as each pixel of two or more pixels arranged at two-dimensional matrix formand generates arbitrary electronic shutter patternsPrescribed period one of the switch for voltage transmission of the pixel decided by the electronic shutter pattern generated in the shutter pattern generating means is carried out simultaneouslyAfter transmitting the voltage from an image sensor to the capacitor for voltage accumulationthe voltage at the time of accumulation of the electronic shutter driving means which makes off the switch for voltage transmission of the pixel decided by the electronic shutter pattern and in which transmission voltage is stored upand the capacitor for voltage accumulation of all the pixelsThe switch for video signal outputs is controlled to one one by one in order of a predetermined pixeland it has composition which has a reading means serially read as a video signal.

[0027]In this inventionafter holding the voltage of the image

sensor of the pixel decided by arbitrary electronic shutter patterns to the capacitor for voltage accumulationit can read as a video signal.[0028]The solid state camera of this invention impressed power supply voltage to the constant current sourcewhen the switch for voltage transmission was oneand when the switch for voltage transmission was OFFit formed further the electric power switch which intercepts the power supply voltage to a constant current sourcein order to attain the above-mentioned purpose.In this inventionwhen the switch for voltage transmission is OFF with an electric power switchin order to make a constant current source non-operativewhen the switch for voltage transmission is OFFthe current which flows into an image sensor can be stopped.
[0029]
[Mode for carrying out the invention]Nextan embodiment of the invention is described with Drawings. Drawing 1 shows the electronic shutter drive method of a solid state camera and the circuit system figure of a 1st embodiment of the important section of a solid state camera which become this invention.Drawing 1 is illustrating a total of four pixels which adjoin two perpendicular directions two horizontally among the pixels of a large number arranged by two-dimensional matrix formrespectively. Photo-diode D1-1 as image sensor with which each pixel performs photoelectric conversionand D1-2and D2-1and D2-2It consists of switch SWa1-1 for resetand SWa1-2and SWa2-1SWa2-2switch Tr1-1 for charge transferand Tr1-2and Tr2-1 and Tr2-2capacitor C1-1 for charge storagesand C1-2and C2-1and C2-2.
[0030]Each non-grounded side terminal of capacitor C1-1 for charge storagesand C2-1Common connection is carried out to level signal switch SH1 via the drain of switch SV1-1 for video signal outputsand SV2-1the sourceand the line L1Common connection of each non-grounded side terminal of capacitor C1-2 for charge storages and C2-2 is carried out to level signal switch SH2 via the drain of switch SV1-2 for video signal outputsand SV2-2the sourceand the line L2. Level signal switch SH1SH2and other level signal switches that are not illustrated are considered as the level read pulse H1 which is outputted from the level actuator 11 and inputted into a gateH2and the period one with other high-level level read pulses which are not illustratedand are considered as period OFF of a low level.
[0031]Switch SV1-k for video signal outputs arranged to switch SV1-1 for video signal outputs and SV1-2 and horizontally [other] it does not illustrate is simultaneously considered as one or OFF by the vertical read pulse V1 of a horizontal scanning cycle which is

outputted from the vertical-drive part 12 and inputted into a gate.SimilarlySwitch SV2-k for video signal outputs arranged to switch SV2-1 for video signal outputsSV2-2and horizontally [other] it does not illustrate is simultaneously considered as one or OFF by the vertical read pulse V2 of a horizontal scanning cycle which is outputted from the vertical-drive part 12 and inputted into a gate.The vertical read pulses V1 and V2 differ in a period only 1 horizontal scanning cycle.[0032]Switch Tr1-1 for charge transfer and Tr1-2 and Tr2-1 and Tr2-2Transfer pulse tp1-1 outputted to each of those gates from electronic shutter drive 13 and tp1-2 and tp2-1 and tp2-2 are impressedand switching control is carried out so that this may become one simultaneously.Reset pulse vp1-1 outputted to each of those gates from vertical-drive part 12 and vp1-2 and vp2-1 and vp2-2 are impressedand switch SWa1-1 for reset and SWa1-2 and SWa2-1 and SWa2-2 are reset simultaneously.

[0033]One pixel with the above-mentioned arbitrary solid state camera can be rewritten as shown in drawing 2 (A).Identical codes are given to drawing 1 and an identical configuration portion among the figureand a subscript in a mark is omitted.A source of the switch SWa for reset according [on drawing 2 (A) and / a cathode] to a field effect transistor (FET) in the photo-diode DWhile being connected to a reset voltage source via a drainit is connected to a drain or a source of switch SV for video signal outputs by the capacitors C and FET for charge storages via a drain of the switch Tr for charge transfer by FETand a source.[0034]Nexta timing chart of drawing 3 (A) is combinedreferred to and explained about operation of this embodiment.Firstthe transfer pulse tp of short high level shown in drawing 3 (A) is impressed to a gate of the switch Tr for charge transfer at the same time the reset pulse vp of short high level shown in drawing 3 (A) is impressed to a gate of the switch SWa for reset. Therebyone [the switch SWa for resetand the switch Tr for charge transfer /respectively] simultaneously.[0035]By one [the switch SWa for reset]a drain of the switch SWa for resetVia a sourcepotential of the cathode Sd of the photo-diode D is fixed to the reset potential Vsas shown in drawing 3 (A)The switch Tr for charge transfer is also one at this timeand since switch SV is OFFpotential of non-grounded side terminal Sc of the capacitor C is fixed to the reset potential Vs as shown in drawing 3 (A).

[0036]Nextas shown in drawing 3 (A)both the reset pulse vp and the transfer pulse tp are set to a low levelthe switch SWa

for reset and the switch Tr for charge transfer are turned offrespectivelyand an object light image is irradiated by the photo-diode D.An electric charge occurs from the photo-diode D with the dose of this object light imageand it dischargesand as the potential of the cathode Sd of the photo-diode D shows drawing 3 (A)it falls gradually from Vs. In the conducting period of this photo-diode Dsince the transfer pulse tp from an electronic shutter drive (13 of drawing 1) is a low levelThe switch Tr for charge transfer is OFFand since switch SV for video-signal read-out is also set to OFF by the vertical driving pulsethe potential of non-grounded side terminal Sc of the capacitor C is fixed to the reset potential Vs as shown in drawing 3 (A).

[0037]Nextafter resettingas the above-mentioned transfer pulse tp shows drawing 3 (A) after a prescribed periodOnly a certain period T is made high-levelthe switch Tr for charge transfer serves as one in this period Tand via the drain of the switch Tr for charge transferand a sourcethe electric charge of the photo-diode D is transmitted to the capacitor Cand is held.Therebyas shown in drawing 3 (A)the potential of the cathode Sd of the photo-diode D rises even from Vi to V1and the potential of non-grounded side terminal Sc of the capacitor C falls even to V2 from Vs. Henceforththe transfer pulse tp serves as a low levelit becomes off switching it for charge transfer Trand the potential V2 is held at the capacitor C.[0038]It will be in the state where the potential V2 was held to the capacitor C for charge storages of all the pixels by performing from the reset to the above-mentioned photo-diode D and the capacitor C to charge transfer operation to the capacitor C in common to all the pixels of a solid state camera.And one [this state / switch SV for video-signal read-out] one by one.

[0039]Thuseven the moment that the switch Tr for charge transfer is turned on from the moment that the switch SWa is come by offin this embodiment turns into an electronic shutter periodsince an electronic shutter period does not change even if one [the same period is simultaneously obtained to all the pixels and / after this / all the switches for video signal outputs] one by onegood Still Picture Sub-Division without blur of a picture is obtained.[0040]in addition -- this embodiment -- the stray capacitance cd of the photo-diode D -- the capacitor C for charge transfer -- abbreviated -- the same thing is desirable.This is because potential will not change easily if all electric charges cannot be transmitted if there is little capacity of the capacitor C for charge transfer in the case of charge transferand there is much capacity of the capacitor C for

charge transfer conversely.
[0041]Drawing 2 (B) shows a circuit diagram of a 2nd embodiment of an important section of a solid state camera which becomes this invention.Identical codes are given to drawing 2 (A) and an identical configuration portion among the figureand the explanation is omitted.This 2nd embodiment is the composition which added amplifier SWv2 by FET to switch SWv1 for video signal outputs by FET.about this 2nd embodiment to explain operation with a timing chart of drawing 3 (B)Firstimpress reset pulse vp' shown in drawing 3 (B) of short high level to a gate of the reset switch SWaandand. [this] A high-level transfer pulse shown in drawing 3 (B) by tp' is impressed to a gate of the switch Tr for charge transfer from an electronic shutter drive (13 of drawing 1)and this is made one. By thispotential of cathode Sd' of the photo-diode D is fixed to the reset potential Vsas shown in drawing 3 (B)The switch Tr for charge transfer is also one at this timeand since switch SWv1 is OFFas potential of non-grounded side terminal Sc' of the capacitor C is also shown in drawing 3 (B)it is fixed to the reset potential Vs.
[0042]Thenalthough reset pulse vp' is set to a low level and turns OFF the reset switch SWaSince unlike the above-mentioned embodiment transfer pulse tp' is made succeedingly high-level as shown in drawing 3 (B)the switch Tr for charge transfer is carried out to one as it isand an object light image is irradiated with it by the photo-diode D in this state.this -- object light -- an image -- a dose -- a photo-diode -- D -- from -- an electric charge -- generating -- discharging -- a photo-diode -- D -- a cathode -- Sd -- ' -- potential -- drawing 3 -- (-- B --) -- being shown -- as -- Vs -- from -- a transfer pulse -- tp -- ' -- a low level -- becoming -- a time -- Vi -- ' -- up to -- gradually -- falling .
[0043]During this conducting periodsince the switch Tr for charge transfer is oneThe electric charge of the photo-diode D is transmitted to the capacitor C for charge storages through the drain of the switch Tr for charge transferand a sourceand as shown in drawing 3 (B)the potential of non-grounded side terminal Sc' of the capacitor C falls even to V2' from Vs.Henceforthtransfer pulse tp' is set to a low levelit becomes off switching it for charge transfer Trand potential V2' is held at the capacitor C.[0044]It will be in the state where potential V2' was held to the capacitor C for charge storages of all the pixels by performing from the reset to the above-mentioned photo-diode D and the capacitor C to charge

transfer operation to the capacitor C in common to all the pixels of a solid state camera.And one [this state / switch SWv1 for video-signal read-out] one by one. since according to this embodiment it is come by off when the switch Tr for charge transfer is in the state where the potential of Sd' and Sc' is the same -- Sc' -- the noise by switching hardly occurs in a sidebut can obtain a good video signal to it. Even if it reads a video signalthe potential of the capacitor C for charge storages cannot changebut can be read repeatedly.[0045]In the embodiment of drawing 2 (B)more capacity of the capacitor C for charge storages is wanted for there to be than the stray capacitance Cd of the photo-diode D.This is because almost all electric charges are accumulated in the capacitor C for charge storageswhen the switch Tr for charge transfer is come by off.

[0046]Nexta 3rd embodiment of this invention is described.Drawing 4 shows a circuit diagram of a 3rd embodiment of an important section of a solid state camera which becomes this invention.Identical codes are given to drawing 2 (A) and an identical configuration portion among the figureand the explanation is omitted.An embodiment shown in drawing 4 has the feature in a point of having connected the switch SWb for reset by FET to a non-grounded side terminal of the capacitor C for charge storages.[0047]In the case of an example of drawing 3 (A) of operationwith this switch SWb for resetit can be set as positions with an arbitrary pulse at the time of reset of the transfer pulse tp. For exampleby carrying out the switch SWb for reset to one just before the charge transfer period Tand resetting the capacitor C for charge storagesSince the potential V2 of non-grounded side terminal Sc of the capacitor C is maintained with a state for read-outthe video signal can also read an irradiation period of an object light imageand it can extend a setting range of an electronic shutter more just before charge transfer. It is effective when forming a video signal which continued especially. It cannot be overemphasized by changing the switch SWb for reset into a state of OFF that operation of drawing 3 (A) and same operation can be performed.

[0048]Nexta 4th embodiment of this invention is described.Drawing 5 shows a circuit diagram of a 4th embodiment of an important section of a solid state camera which becomes this invention. Drawing 5 constitutes stroke matter of a solid state cameraand to a cathode of the photo-diode D. While a source of the transistor Q1 for constant current sources to which a gate and a drain were

connected is connectedit is connected to a source of capacitor Cv for voltage accumulationand the transistor Q2 via the switch Trv for charge transfer.A gate and a drain are connected to a drain of the switch Q3 for video signal outputsand the transistor Q2 constitutes a buffer amplifier.[0049]Nexta timing chart of drawing 6 is combinedreferred to and explained about operation of this embodiment.If the direct-current driver voltage Vcc is impressed to a gate and a drain of the transistor Q1the constant current Is will flow into the photo-diode D.The resistance Rx changes according to light volume of an entering object light imageand the photo-diode D generates voltage Vd1 (=IsxRx) in a cathode. This voltage Vd1 changes continuously according to an object light imageas shown in drawing 6 (A).

[0050]Nextto a gate of the voltage transfer switch Trvas shown in drawing 6 (B)If the high-level transfer pulse tp is impressedthe voltage transfer switch Trv is turned onand at the time of transmission of voltage Vd1through a drain of the voltage transfer switch Trvand a sourcethe voltage V1 will be transmitted to capacitor Cv for voltage accumulationand will be held. The voltage Vx accumulated in capacitor Cv for voltage accumulation before transmission can be easily changed to the voltage V1 at the time of transmission by making capacity of capacitor Cv as small as possibleand there being few electric charges accumulated and making it end.[0051]If the resistance Rx shall fall according to below abbreviated 10komega carrying out the resistance Rx in case there is no optical exposure of the photo-diode Dand incident light quantity increasing and capacity of capacitor Cv for voltage accumulation shall be 10 pF or lessSince a damping time constant is expressed with Rx-Cvit becomes very short with a 10^{-7} ($=10x10^{3}x10x10^{-12}$) secondand voltage transmission is also performed in an instant in proportion to this time. And since the switch Trv for voltage transmission is offan input-impedance value of capacitor Cv for voltage accumulation other than the time of transmission is very as high as more than abbreviated 10^{10}omegaThereforea damping time constant at this time serves as one ($=10x10^{10}x10x10^{-12}$) secondand its accumulation performance is also practical for a long time enough to 33 milliseconds of Vertical Synchronizing signal periods of an NTSC television system.

[0052]The transfer pulse tp nextby making the switch Trv for voltage transmission off as a low levelas shown in drawing 6 (B)The voltage V1 transmitted to capacitor Cv for voltage accumulation to timing shown by a in front of OFF is

accumulated in capacitor Cv for voltage accumulation as voltage Vd2 [equivalent to V1]as a' shows to the figure (C). Thenby the one by making high-level to timing shown in drawing 6 (D) the pulse tv impressed to a gate of the output switch Q3 for video signalsThe video signal Vout as the accumulation voltage c at the one time shows to drawing 6 (E) by c' via the buffer amplifier Q2 and the switch Q3 for video signal outputs is obtained.

[0053] By making the transfer pulse tp into a high-level back low levelafter 1 vertical scanning periodThe voltage V2 of the photo-diode D transmitted to the timing b in front of OFF of the transfer switch Trv shown in drawing 6 (A)It is accumulated in capacitor Cv by timing b' shown in the figure (C)and terminal voltage (accumulation voltage) Vd2 (=V2) of the capacitor Cv to the timing d whose switch Q3 for video signal outputs serves as one by the pulse tv.It is obtained via the buffer amplifier Q2 and the switch Q3 for video signal outputs as the video signal Vout as shown in drawing 6 (E) by d'.

[0054]Hereafterif it repeats similarlythe stationary video signal which does not have blur for every screen can be obtained. the inside of drawing 6 (E)c'and d' -- the output voltage Vout at the time of except is the output voltage from other pixels of composition similarly other than the pixel shown in drawing 5.The output voltage Vout is outputtedfor example to linessuch as the line L1 of drawing 1and L2.[0055] Nexta 5th embodiment of this invention is described.Drawing 7 shows the circuit diagram of a 5th embodiment of the important section of the solid state camera which becomes this invention. Among the figuredrawing 5 and an identical configuration portion attach identical codesand omit the explanation.Drawing 7 constitutes the stroke matter of a solid state cameraand the feature is at the point of having connected the gate and drain of the transistor Q1 for constant current sources to direct current voltage supply via electric power switch SWvcc. This electric power switch SWvcc is one piece common to all the pixels.It is because the switch Trv for voltage transmission of all the pixels is controlled simultaneously at one or OFF.

[0056] Namelythe direct current voltage Vcc applied to the transistor Q1 for constant current sources in this embodimentIt aims at omitting at the time of OFFsince it is required only when the transfer pulse tp is onestopping the current which flows into the photo-diode Dand planning power savingThe transfer pulse tp is high-leveland only when the switch Trv for voltage transmission is considered

as oneelectric power switch SWvcc is made to be considered as one by the transfer pulse tp.[0057]Although the transistor Q1 for constant current sources increased [4th and 5th above-mentioned embodiments]since a transfer part and a reset part are omitted and the transistors Q2 and Q3 in drawing 5 and drawing 7 can be formed by oneSince it is conventionally [which was shown in drawing 11] equivalent to JFET of equipmentthe constituent child can compare with equipment conventionally which was shown in drawing 11and can decrease in number by one. Since a reset pulse is unnecessarythe composition of an electronic shutter becomes very easy since one kind of tp may be sufficient also as a transfer pulseand the noise by a reset pulse moreover is not generatedeitherthe good Still Picture Sub-Division video signal is obtained.
[0058]Nexta 6th embodiment of this invention is described.Drawing 8 (A) shows a block diagram of a 6th embodiment of an important section of a solid state camera which becomes this invention.This embodiment is 1 embodiment of the electronic shutter drive 13 of a solid state camera shown in drawing 1The synchronizing signal generator 21 which generates horizontal driving signal HDthe vertical driving signal VDand reference clock Clock based on an outside water common synchronized signal and an external Vertical Synchronizing signalrespectivelyThe interface circuitry 22 which outputs the area data (Area data) based on CDCThe shutter pattern generator 23 which receives each output signal of the above-mentioned synchronizing signal generator 21 and the interface circuitry 22 as an inputand generates a clocklevel area signalvertical area signaland memory pulsea gate pulseetc.It comprises the shift registers 24 and 25the memories 26 and 27the gates 28 and 29and the electronic shutter switch 30.[0059]Operation of this embodiment is explained.Firstas area data of an electronic shutterby interface circuitry 22 courseCDC is inputted into the shutter pattern generator 23and is memorized from a personal computer etc. Nexta horizontal driving signal (HD)a vertical driving signal (VD)and a reference clock signal (Clock) which were generated from the synchronizing signal generator 21 are sent to the shutter pattern generator 23. A horizontal driving signal (HD) from this synchronizing signal generator 21a vertical driving signal (VD)and a reference clock signal (Clock) are synchronized with external Horizontal Synchronizing signal H.sync and external Vertical Synchronizing signal V.sync if needed.
[0060]Nextsupply serially the level area data generated

from the shutter pattern generator 23 to the shift register 24and it is shifted to it one by one with a clockand vertical area data is serially supplied to the shift register 25and is shifted to it one by one with a clock. Level area data or vertical area data is binary data as shown in drawing 8 (B) by a. Thenthe shutter pattern generator 23 makes the memory pulse shown in drawing 8 (B) by c high level (one)Namely [at once]the level area data and vertical area data which are shown in drawing 8 (B) stored temporarily at the shift registers 24 and 25respectively by b are parallel transmitted to the memories 26 and 27and are made to memorize.

[0061]Each horizontal and vertical area data shown in drawing 8 (B) memorized by the memories 26 and 27respectively by dSince it is always sent to the gates 28 and 29 provided by correspondingthenthe shutter pattern generator 23By making high-level a gate pulse outputted to the gates 28 and 29 at drawing 8 (B)as e showsand making the gates 28 and 29 oneEach horizontal and vertical area data (f2 of drawing 8 (B)) which is memorized by the memories 26 and 27 and which was created with the shutter pattern generator 23 is supplied to the electronic shutter switch 30 at once through the gates 28 and 29.An electronic shutter pattern which consists of each area data level and vertical to the electronic shutter switch 30 by this is memorized.

[0062]Based on the electronic shutter pattern memorized by the electronic shutter switch 30 at this timethe transfer pulse tp is outputted to said switch Tr for charge transferor the switch Trv for voltage transmission from the electronic shutter switch 30.The picture element position where both area data inputted from the area data into which the electronic shutter switch 30 is inputted from the gate 28and the gate 29 is high-levelThe high-level transfer pulse tp is impressed to the gate of the switch Tr for charge transferor the switch Trv for voltage transmissionand it is considered as one.

[0063]Nextturn OFF a gate pulse and a different electronic shutter pattern is sent to the electronic shutter switch 30 in the same courseBy carrying out the video output switch of all the pixels to one finally at the predetermined order of a pixelcollecting as a video signal and readingthe multiple image by the electronic shutter of time to differ is obtained as same Still Picture Sub-Division video signal. If it does in this wayhigh-speed video can be easily constituted as a still picture in the same screen.

[0064]Drawing 9 shows the general example of use of a solid

state camera.As shown in the figurethe solid state camera 33 condenses the incident light from the object light image 31 by the optical system 32and photoelectric conversion is entered and carried out to the photo-diode of the solid state camera 33A video signal is read synchronizing with the synchronized signal from the synchronized signal drive system 34the signal-processing system 35 is suppliedand predetermined signal processing is performedfor exampleit is changed into the video signal of NTSC system or a PAL system.[0065]This invention is not limited to the above-mentioned embodimentand can also use transfer pulse tp' shown in drawing 3 (B)for example as the transfer pulse tp of a 1st embodiment shown in drawing 2 (A).
[0066]
[Effect of the Invention]As explained aboveaccording to this inventionat a point the electric charge according to the light volume of the object light image which entered into all the image sensors temporarily [the] by accumulating in the capacitor for charge storages of all the pixels simultaneouslyrespectivelySince the stored charge of the **** object light figure of the same time can be reada clear still picture can be obtained easily.
[0067]According to this inventionsince the switch for charge transfer can turn OFF when the potential of an image sensor and the capacitor for charge storages is in the same state by changing simultaneously the charge quantity of the image sensor of all the pixelsand the capacitor for charge storagesa picture with few reset noises can be acquired.
[0068]According to this inventionirradiating with the image sensor of all the pixels of the whole 1 screen by the object light image of the same time by an electronic shutterand having acquired the output video signaleven if it did not use a resetting means A sakesince the composition of an electronic shutter can be simplified dramatically and the noise by a reset pulse is not generatedeitherthe Still Picture Sub-Division video signal of good quality can be obtained.
[0069]After holding the voltage of the image sensor of the pixel decided by arbitrary electronic shutter patterns to the capacitor for voltage accumulation according to this inventionhaving made it read as a video signal A sakeBy highlighting the picture of the field of the request in one screenor changing a shutter positionvideo can be divided into two or more still picturesand can also be displayed.
[0070]According to this inventionsince the current which flows into an image sensor was stopped when the switch for voltage transmission was OFF by making a constant current

source non-operative with an electric power switch when the switch for voltage transmission is OFFpower consumption can be reduced.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is the electronic shutter drive method of a solid state camera and the circuit system figure of a 1st embodiment of the important section of a solid state camera which become this invention.
[Drawing 2]It is a circuit diagram of 1st and 2nd embodiments of the important section of the solid state camera which becomes this invention.
[Drawing 3]It is a timing chart for explanation of operation of drawing 2.
[Drawing 4]It is a circuit diagram of a 3rd embodiment of the important section of the solid state camera which becomes this invention.
[Drawing 5]It is a circuit diagram of a 4th embodiment of the important section of the solid state camera which becomes this invention.
[Drawing 6]It is a timing chart for explanation of operation of drawing 5.
[Drawing 7]It is a circuit diagram of a 5th embodiment of the important section of the solid state camera which becomes this invention.
[Drawing 8]It is the 6th block diagram and signal waveform diagram of an embodiment of an important section of a solid state camera that become this invention.
[Drawing 9]It is a figure showing an example of the example of use of a solid state camera.
[Drawing 10]It is a circuit diagram of an example of equipment conventionally.
[Drawing 11]It is a circuit diagram of other examples of equipment conventionally.
[Explanations of letters or numerals]
11 Level actuator
12 Vertical-drive part
13 Electronic shutter drive
21 Synchronizing signal generator
22 Interface circuitry
23 Shutter pattern generator
24 and 25 Shift register
26 and 27 Memory
28 and 29 Gate

30 Electronic shutter switch
SWa and SWa1-1 and SWa1-2 and SWa2-1SWa2-2and SWb Switch for reset
SV and SV1-1 and SV1-2 and SV2-1SV2-2SWv1and Q3 Switch for video signal outputs
D Photo-diode
Tr Switch for charge transfer
C The capacitor for charge storages
Cd Photo-diode stray capacitance
vp and vp' reset pulse
tp and tp1-1 and tp1-2 and tp2-1 and tp2-2 Pulse for electric charge (voltage) transmission
Q1 Transistor for constant current sources
Q2 buffer amplifier
Trv Switch for voltage transmission
Cv Capacitor for voltage accumulation
Vd1 Photo-diode terminal voltage
Vd2 Voltage accumulation capacitor terminal voltage